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Title of Invention: Method for manufacturing modified starch

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Specifications

1. Title of Invention:

Method for manufacturing modified starch

2. Claims:

A method for manufacturing modified starch, characterized in that waxy corn starch and/or waxy corn starch derivatives are heat-treated at a temperature of 100–200°C and at a pH of 3.5–8.0, preferably 4.0–5.0.

3. Detailed Explanation of Invention:

Field of Use in Industry

The modified starch of this invention has excellent stability after gelatinization, transparency, and emulsifiability; therefore, it is useful in many fields, such as candy-making, drug tablet making, gum jellies, emulsified flavors, paints, etc.

Conventional Technology

In the aforementioned fields, gum Arabic has been used up to now because of its excellent emulsifiability, coating ability, and stability after gelatinization.

Problems Which This Invention Seeks to Solve

As mentioned above, gum Arabic has been used up to now, but it has the problems that since it is a natural product, a stable supply cannot be obtained, and there are great

variations in its price. Moreover, gum Arabic has many foreign substances mixed in with the resin, and thus there is the problem that it must be filtered when it is used.

Means for Solving These Problems

The inventors performed careful investigations to solve these problems, and as a result they discovered that a substitute for gum Arabic with excellent stability after gelatinization, transparency, and emulsifiability can be obtained by heat-treating waxy corn starch and/or waxy corn starch derivatives at a temperature of 100–200°C and at a pH of 3.5–8.0, preferably 4.0–5.0.

As the starch raw material used to manufacture the modified starch of this invention, one can use waxy corn starch or substances obtained by acidifying, acid-treating, enzyme-treating, etherifying, esterifying, crosslinking, or grafting it.

When they are heat-treated by the dry method, the water content in the waxy corn starch and/or waxy corn starch derivatives must be 10% or less, preferably 5% or less. If it is greater than 10%, the starch will be partially gelatinized by water drops condensing due to the heating, and will be solidified.

When they are heat-treated by the wet method, the concentration may be 5–50%, preferably 20–30%.

The pH range is 3.5–8.0, preferably 4.0–5.0. If it is 3.5 or less, the emulsifiability will be inferior, and if it is greater than 8.0, there will be marked discoloration, which is undesirable.

The heating temperature may be 100–200°C, preferably 130–180°C.

The heat treatment time varies with the heating temperature, but it is within the range of 0.5–8 hours, preferably 3–4.5 hours.

Operation of Invention

Since the modified starch of this invention has excellent stability after gelatinization, transparency, and emulsifiability, it can be used advantageously in place of gum Arabic in many fields, such as candy-making, drug tablet making, gum jellies, emulsified flavors, paints, etc.

Actual Examples

Next, this invention will be explained in more detail by giving actual examples.

Actual Example 1

Five kg waxy corn starch were dried to a water content of 2.5%; this was heated for 3 hours at 180°C, and a heat-treated waxy corn starch (Sample No. 1) was obtained.

Actual Example 2

Five kg waxy corn starch were dispersed in 7 liters of water, 1 kg sodium hypochlorite was added, and heating was performed for 3 hours at pH 9–10 and 25°C; desalting was performed with sodium sulfite, and the pH was adjusted to 4.0 with hydrochloric acid. After this, washing with water, dehydration, and drying were performed, and acidified waxy corn starch (Sample No. 2) was obtained. This was dried to produce a water content of 3%, and the result was heat-treated at 150°C for 1 hour; heat-treated, acidified waxy corn starch (Sample No. 3) was obtained.

Actual Example 3

Fifty ml hydrochloric acid were dissolved in 7 g water and 5 kg waxy corn starch were dispersed in it; after the reaction was performed at 45°C for 5 hours, the pH was adjusted to 4.0 with sodium hydroxide, after which washing with water, dehydration, and drying were performed. Dried, acid-treated waxy corn starch (Sample No. 4) was obtained. This was dried to produce a water content of 3.2%, and the result was heat-treated at 130°C for 1 hour 30 minutes; heat-treated, acid-treated waxy corn starch (Sample No. 5) was obtained.

Actual Example 4

Two hundred g waxy corn starch were dispersed in 800 ml water, and the result was heat-treated at 130°C for 2 hours in an autoclave with a stirrer attached. The result was dried in a drum dryer, and wet-method heat-treated waxy corn starch (Sample No. 6) was obtained.

Actual Example 5

Five kg waxy corn starch were dispersed in 10 liters of water and the pH was adjusted to 7 with sodium carbonate; 5 g alpha amylase were added, and reaction was performed at 85°C for 1 hour. After this, drying was performed with a spray dryer, and enzyme-modified waxy corn starch (Sample No. 7) was obtained. This product, with a water content of 3%, was heat-treated at 140°C for 1 hour, and heat-treated, enzyme-modified waxy corn starch (Sample No. 8) was obtained.

Actual Example 6

Five kg hydroxypropylated waxy corn starch were dried to a water content of 3%; this product was heat-treated at 180°C for 3 hours, and heat-treated hydroxypropylated waxy corn starch (Sample No. 9) was obtained.

Actual Example 7

A comparison test was performed among Samples Nos. 1–9, obtained in Actual Examples 1–6, both heat-treated and non-heat-treated. The results are shown in Table 1.

In this table, the "changes in viscosity over time" were measured by making a slurry with a concentration of the sample (converted to the anhydrous form) of 30%, heating it for 10 minutes at 85–95°C to gelatinize it, and then cooling it to 30°C; the viscosity was measured with a type B [*or: Model B*] viscosimeter. The measurement was performed on the day this operation was performed and again after 3 days at 30°C.

The emulsifiability was measured by dispersing 1 g of the sample in 50 ml water and heat-treating it at 85–95°C for 10 minutes, after which it was cooled, 50 ml soybean oil were added, and the result was emulsified in a homomixer for 1 minute (11,000 rpm). The result was transferred to a 100 ml graduated cylinder and left standing for 8 hours at room temperature; the volume of the emulsified layer was read, and the whiteness of the emulsified layer was measured with a whiteness meter (Ketto Co.).

Actual Example 8

Fifteen parts (by weight; same below) orange flavor, 7 parts of Sample No. 1, 25 parts enzyme-modified dextrin (DE12), and 53 parts water were emulsified in a homo-

mixer for 1 minute (11,000 rpm) and dried with a spray dryer, to obtain an orange flavor powder.

0.1 g of this product was dispersed in 100 ml water; a dispersion with a good stability was obtained.

Effectiveness of Invention

As is clear from the actual examples, the modified starch of this invention has excellent stability and emulsifiability, and the gelatin form is easy to prepare. It is also stable in price and supply, and can be used advantageously as a gum Arabic substitute.

Table 1

a	b	c				i
		d	e	g	h	
1	加熱処理ワキシコーンスターチ j	850	1300	80	54	良好 t
3	加熱処理酸化ワキシコーンスターチ k	350	2000	60	35	良好 t
5	加熱処理酸処理ワキシコーンスターチ l	450	2300	65	42	良好 t
6	湿式加熱処理ワキシコーンスターチ m	1200	1600	80	50	良好 t
8	加熱処理酵素変性ワキシコーンスターチ n	12	12	60	35	良好 t
9	加熱処理ヒドロキシプロピル化ワキシコーンスターチ o	700	810	80	52	良好 t
2	酸化ワキシコーンスターチ p	1200	24000	55	22	油層半分程度分離 u
4	酸処理ワキシコーンスターチ q	950	35000	50	17	油層完全分離 v
7	酵素変性ワキシコーンスターチ r	14	14	50	17	油層完全分離 v
	アラビアガム s	90	100	85	62	良好 t

a. Sample No.
b. Sample name
c. Change in viscosity over time
d. Viscosity on day of manufacture
e. Viscosity after 3 days
f. Emulsifiability
g. Volume of emulsified layer
h. Whiteness of emulsified layer
i. State of emulsion
j. Heat-treated waxy corn starch
k. Heat-treated, acidified waxy corn starch
l. Heat-treated, acid-treated waxy corn starch
m. Wet-method heat-treated waxy corn starch
n. Heat-treated, enzyme-modified waxy corn starch
o. Heat-treated, hydroxypropylated waxy corn starch
p. Acidified waxy corn starch
q. Acid-treated waxy corn starch
r. Enzyme-treated waxy corn starch
s. Gum Arabic
t. Good
u. Oil layer about half-separated
v. Oil layer completely separated